The Economic Effects of Proposed Changes to Ohio's Animal Housing Regulations on Egg Producers and Consumers

Angela Black

The Ohio State University

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Abstract

In 2008, Californians passed a constitutional ballot initiative which dictates housing regulations for several livestock species, including egg-laying hens, in that state. Animal welfare groups are now pursuing a similar ballot initiative in Ohio. Proposed regulations would ban the use of battery cages, which are currently used in 98% of Ohio's egg laying operations. The purpose of this study was to determine the economic effects the proposed measures would impose on egg producers and consumers in Ohio. Total transition costs for Ohio's egg industry were calculated using industry data from the USDA National Agricultural Statistics Service, the US Census of Agriculture, a poultry housing provider, and from three recent studies featuring primary data from the California egg sector. Conversion costs were compared to potential revenue gains associated with sales to the cage-free market. My results suggest that, if enacted, banning caged housing in Ohio will impose significant costs on the state's producers. Also, if all of Ohio's current production became cage-free, the cage-free egg market would become flooded, causing current retail price premiums to disappear. Ohio farmers would not be able to afford the production costs of cage-free eggs when receiving the lower price the market would offer and would therefore exit the market, most likely with only current cage-free producers remaining. It is also likely that these farmers' costs would increase due to the loss of economies of scale of large producers in the state who currently produce eggs using both methods.

Introduction

Animal welfare has recently become an important topic to the general public. Due in large part to pressures and campaigns by groups such as People for the Ethical Treatment of Animals (PETA) and the Humane Society of the United States (HSUS), livestock producers are being forced to defend their current husbandry practices and, in some cases, to change operating procedures. Of late, these changes have been introduced via state ballot initiatives and demands by large chain restaurants and largely focus on how veal calves, sows, and egg-laying hens, are housed. This study focuses on egg-laying hens which, in most modern confinement systems, are housed in stackable battery cages.

Animal welfare advocates have helped change animal housing rules in Europe by promoting the adoption of the "Five Freedoms" by the United Kingdom's Farm Animal Welfare Council and subsequently by the European Commission, including a ban on gestation stall use (Animal Welfare on the Farm, 2009). PETA and the HSUS have changed animal housing rules via ballot initiatives in the United States with the ban of gestation stalls in five states, veal crates in three states, and battery cages in California (Thinking Outside the Crate Campaign, 2009). They have also helped influence industry guidelines toward providing an overall larger cage size for egg-laying hens (Guidelines, 2002).

The most recent change in housing rules occurred in 2008, when the Humane Society of the United States (HSUS) helped place an initiative on California's general election ballot, which eventually passed. This ballot initiative changed the California constitution to dictate housing regulations for several livestock species, including egg-laying hens (Veal Crates, Gestation Crates and Battery Cages Banned, 2008). The legislation passed in California does not specify a

measurement for the minimum space requirements, but for egg-laying hens confined for egg production, it simply states the bird must be:

> "fully extending all limbs without touching the side of an enclosure, including, in the case of egg-laying hens, fully spreading both wings without touching the side of an enclosure or other egg-laying hens." (Sumner et al., 2008)

In 2009, Ohio voters passed legislation to create the Ohio Livestock Care Standards Board (OLCSB). This thirteen member board of Ohioans - which includes the Director of Agriculture, three family farmers, two veterinarians (including the state veterinarian), a food safety expert, a representative of a local humane society, two representatives of statewide farm organizations, the dean of an Ohio agriculture college and two representatives for Ohio consumers - will be responsible for reviewing and setting standards for Ohio farmers in respect to the care of farm animals, including the way they are housed (Ohio Livestock Care Standards Board News, 2010).

At the same time as the state is implementing the OLCSB, the HSUS is pursuing an initiative for the November 2010 general election ballot in Ohio (Ohioans for Humane Farms Petition for Anti-Cruelty Measure, 2010). With respect to egg-laying hens, the proposed regulations would ban the use of battery cages, which are currently used in 98% of Ohio's egg laying operations.

Purpose of this Study

To date, most studies have focused on the animal welfare arguments in support of and against current housing systems. This study provides an economic approach to the debate in order to demonstrate the economic effects the proposed measures would impose on egg producers and consumers in Ohio. It analyzes the production costs for both conventional battery

cage and cage-free systems, the price sensitivity of eggs, as well as the total cost for converting the egg industry to cage-free production in Ohio.

Egg Industry in Ohio

In 2007 Ohio had more than 27 million laying hens producing over 7 billion eggs, ranking it second in both number of layers and egg production nationwide (2007 Annual Report and Statistics, 2008). Ohio supplies 9.6% of the nation's eggs, while the industry adds $1.5 billion to Ohio's overall economic activity, and provides over 12,000 jobs to the state (Promar International, 2009). Only 2% of Ohio's eggs currently come from cage-free housing systems.

Housing Systems

Two housing systems are discussed in this study: conventional battery cages and cage-free aviaries. With proper management, both systems provide an adequate living environment for egg-laying hens.

Conventional battery cages are used in 98% and 95% of egg production in Ohio and the United States respectively (Sumner et al., 2008; Promar International, 2009). This is a system of wire cages that are about 15 to 16 inches tall at the rear of the cage and higher at the front, with floor space from 12 by 18 inches to 20 by 24 inches, stacked on top of each other. The floors are sloped to allow for automatic egg collection, and manure is collected outside of the cages away from the birds. Five to eight hens are housed in each cage, depending on cage size (Sumner et al., 2008).

This system allows for better hygiene, easier management of birds, cleaner eggs, lower mortality, lower risk of disease and parasitism, less aggression, and better air quality. The major

drawbacks with conventional battery cages are restrictions in bird movement and behavior, such as nesting, dust bathing and perching (Sumner et al., 2008).

Cage-free aviary systems consist of thousands of hens housed together in a building with multiple platforms. The ground level is usually covered with litter material, and upper levels are arranged to prevent manure from falling on birds below. The system also features perching surfaces and nest boxes, with food and water at each level (Sumner et al., 2008).

Cage-free systems allow the hens more movement and the ability to perform behaviors not expressible in conventional cage systems. However, these housing configurations tend to be more difficult to manage, experience higher mortality, have birds with more aggressive behavior and more infection from parasites, be subjected to higher levels of ammonia and dust, and present difficulty in catching hens for inspection (Sumner et al., 2008).

Production Costs

In their study, Sumner et al. (2008) determined the cost to produce a dozen eggs in California using both conventional and cage-free systems. Sumner et al.'s data is nearly ideal for studying the differences in costs between the two systems, because the data was gathered from California operations that featured both conventional and cage-free production at the same facility, using the same accounting procedures and under the same management team. Therefore, the cost differences identified by Sumner et al. truly isolate the difference in cost attributable to the different housing systems, rather than to incidental differences in management quality, accounting procedures or local cost conditions.

This study follows the same format to estimate costs for Ohio, and bases calculations on Sumner et al.'s cost differences adjusted for categorical cost differences between California and

Ohio. Therefore, production costs equal the sum of the costs of replacement pullets, feed, housing, and labor and are expressed in terms of dollars ($) per dozen.

To determine the cost of production for the conventional battery cage system, each category was calculated by taking the ratio of Ohio costs to California costs and multiplying that number by the dollar per dozen cost Sumner and his colleagues found in their study (2008). The ratio of Ohio to California costs are listed in Table I.

The evidence suggests that cage-free systems incur higher production costs due to increases in each of the main cost categories. Feed usage is higher due mainly to the additional physical activity of hens and the fact that brown breeds, which are most often used in cage-free systems, require more feed to produce a dozen eggs than White Leghorn hens. This increases feed costs by 17%. For these same reasons, pullet costs increase by 55%. Furthermore, one worker can efficiently manage only 30,000 hens in a cage-free system, compared to 100,000 in a conventional system, which raises labor costs by 27%. Finally, housing costs increase 41% due to the need for additional houses to keep inventories consistent since each bird requires more space in a cage-free system. It is also common for a hen to have a shorter laying cycle in a cage-free environment, decreasing production by about 10%. The eggs these birds produce also tend to be smaller in size and volume than eggs in the conventional system (Sumner et al. 2008). To account for these added costs, the dollar per dozen costs found for the conventional system were increased in each category by their respective amount to determine cage-free costs.

Additional costs such as overhead, taxes, and miscellaneous expenses are added to the sum of the four main cost categories to determine the total production cost of a dozen eggs in each system.

I find the cost per dozen eggs to be approximately $0.63 when produced in the conventional cage system versus $0.87 per dozen by cage-free methods. That is an additional $0.24 or 39% per dozen (Table II).

Ohio Farm Example

Using these costs, it is possible to demonstrate how changing housing systems would impact an Ohio farmer with egg-laying hens. Consider an Ohio farm with 200,000 total layers in two houses of 100,000 hens each. With the conventional cage system, the farmer's hens produce about 4.4 million dozen eggs at a total cost per dozen of $0.63. The farmer receives an average of $0.85 per dozen (2007 Annual Report and Statistics, 2008) for those eggs, so:

Net Revenue = ($0.85 x 4,402,000) - ($0.63 x 4,402,000) = $968,440

Before that farmer can begin producing cage-free eggs, he or she must have the appropriate housing. Current houses can be renovated at a cost of $9 per hen, however, 60% of the capacity will be lost (Pollard, 2010). In order to keep the same capacity he or she previously had, new houses must be built at a cost of about $21 per hen, which includes costs for additional land and utilities (Pollard, 2010; Promar International, 2009). This means:

Total Construction and Renovation Costs =
[(200,000 x 0.4) x $9] + [(200,000 x 0.6) x $20.90] = $3.23 million

Once the new cage-free system is in place, the farmer will be producing only 3.9 million eggs at a higher cost of $0.87 per dozen. Since no published data could be found showing the actual price received by farmers for cage-free eggs, this was calculated as 42.5% of the retail price (Promar International, 2009), which was $2.78 per dozen in 2007 (Price Report, 2007). Therefore, the farmer sees a slight increase in the amount he or she receives per dozen at slightly more than $1. Following the same formula:

Net Revenue = ($1.18 x 3,962,488) - ($0.87 x 3,962,488) = $1,228,371

Renovation and construction costs will most likely be financed with a 10% down payment and 90% debt in the form of a 20 year loan at 8% interest. Annual mortgage payments would come to $291,780 and net revenue for the cage-free system falls to $936,591. It is important to note that many farmers are already financing their conventional laying houses and may end up paying off both loans concurrently, lowering net revenues even further.

Another important note is that the production costs presented for the cage-free system are most likely best case scenarios. Most farms that provide cage-free eggs for the commercial market are also major suppliers of conventionally produced eggs as well, therefore they are receiving many of their inputs at economies of scale that would disappear if cage production were banned.

Possible Outcomes

As you can see, net revenues for the two systems are similar, showing that it is possible to profitably operate a cage-free egg laying operation - 2% of farms in Ohio and 5% in the United States already do. There is a niche market and some consumers pay a premium at the grocery store for cage-free eggs that yield a price 100 to 200% higher than conventional cage-raised eggs. The above analysis is conducted under the assumption that only one farm is converting to cage-free production and that the amount of additional cage-free eggs doesn't impact the farm-level price for cage-free eggs. A small increase in cage-free egg production such as this will likely have negligible effects on the market price for such eggs.

However, this would likely change if legislation banning the use of battery cages in Ohio was passed and cage-free egg production increased. Ohio's annual production of 7.1 billion eggs

is nearly double the current cage-free production of 3.85 billion eggs nationwide. If all 7.1 billion eggs became cage-free, the supply of cage-free eggs in the U.S. would nearly triple. Such an excess in supply would significantly drive down the retail price of cage-free eggs, and with it, the price farmers receive for those eggs. This would make it difficult for farmers to justify production when the cost to produce a dozen eggs is more than they would receive for it.

The more likely challenge facing Ohio producers is the availability of cheaper alternatives that can be imported easily from other states. Legislation passed in California does not prohibit the *consumption* of cage-raised eggs in California, simply the *production* of cage-raised eggs in California, and the same would be true for Ohio. Therefore, farmers in Midwestern states who can produce cage-raised table eggs more efficiently will ship their eggs to Ohio at a cost so minimal consumers would hardly see a difference in price. Indiana and Pennsylvania are ranked in the top five egg-producing states in the United States, and, given enough time, may be able to increase production levels enough to supply Ohio consumers with sufficient supplies of conventionally produced eggs. Consumers may not even realize they are purchasing eggs produced in another state. If eggs are available to consumers at current prices, the majority will not be interested in changing their purchasing habits to buy the more expensive cage-free Ohio eggs, leaving little market for Ohio's many eggs, again causing farmers difficulty in justifying the costs of cage-free production.

Sensitivity Analysis

To determine the extent to which these two scenarios would impact Ohio's egg industry, a sensitivity analysis was conducted based on a second study by Sumner et al. (2010). Egg production in Ohio was predicted using the following equations:

1. $dlnP = (\sigma_{ohio}\varepsilon/(\eta-\varepsilon))(dlnC_{ohio})$
2. $dlnQ^{Ohio} = \varepsilon(dlnP - dlnC_{ohio})$
3. $dlnQ^{R} = (1-\sigma_{ohio})\varepsilon dlnP$

where

$dlnP$ = percentage change in price of eggs (same for Ohio and US)
$dlnQ^{Ohio}$ = percentage change in quantity of egg production in Ohio
$dlnQ^{R}$ = percentage change in quantity of egg production in the rest of the US
ε = long run supply elasticity for eggs (same for Ohio and US)
η = long run demand elasticity for eggs (same for Ohio and US)
σ_{ohio} = Ohio's share (percent) of national production
$dlnC_{ohio}$ = percentage change in marginal cost of production for Ohio

Plugging in the 39% increase in production costs found in our earlier calculations ($dlnC_{ohio}$), Ohio's 9.6% share of the country's egg production (σ_{ohio}), -0.2 for long run demand elasticity (η), and long run supply elasticities of 5.0 and 10.0 (ε), I find the price of conventional eggs to rise 1.85% in the short term and 0.94% in the long term. These results show that producers are very sensitive to changes in costs, indicating that the increase in marginal costs from banning cage production would eliminate egg production in Ohio. At the same time, production in the rest of the U.S. would increase more than 8% to supply the market with the eggs lost from Ohio production(Table III).

Total Industry Conversion Costs

In 2009, Promar International conducted a study in which they calculated the total conversion costs for all of U.S. egg production to go cage-free. The study considered current production, the price elasticity of table eggs, the number of eggs required by the market, as well as the number of birds needed to produce the projected number of eggs. It also took into account the renovation and new construction costs of housing for both the laying hens and replacement pullets.

Using that same format, this study calculated the total conversion costs for all of Ohio egg production to become cage-free. If all egg-laying farms in Ohio make the switch to cage-free and continue to meet their current production levels (including out-of-state shipments), the total cost of conversion would be $349.7 million. This would require consumers in Ohio and its export states to agree to pay the 100-200% price premium for cage-free eggs (Table IV).

However, if I assume neighboring states can ship conventional eggs into Ohio (import displacement), the simulation predicts that layer inventory after conversion will require significantly fewer hens (more than 24 million birds less than Ohio's current capacity) to meet production requirements due to out-of-state import displacement. Import displacement occurs when eggs from outside Ohio are shipped to the state and take away from Ohio's portion of the market share of eggs sold to Ohioans. According to the simulation, egg imports to the state of 25% or more would cause the required inventory to drop below current levels and farmers to exit the market. Cheaper, cage-raised alternatives would be easily accessible, so Ohio's import displacement will likely be 90% or greater, based on the fact that 2% of production currently serves the cage-free market and a few farmers may be able to manage their operations efficiently enough to contend with out-of-state competitors.

Conclusion

Legislation that allows only cage-free housing for egg-laying hens in Ohio would be detrimental to the state's egg industry. Farmers would face production costs 39% greater per dozen than those able to produce in the conventional battery cage system, while getting fewer, and actually smaller, eggs from their hens. They would also incur substantial costs to convert their existing operations to meet cage-free requirements. Adding Ohio's newly cage-free

production to the national supply would flood the market for cage-free eggs, causing the price premium for cage-free eggs currently enjoyed at the retailer to disappear. Without the premium, it would not be economically sound to continue producing as costs would be greater than income. Likewise, cheaper, cage-raised alternatives would be shipped into the state at little additional cost to the consumer, so these more efficiently produced eggs will displace Ohio's more expensive eggs in the market. Without an outlet for their production, Ohio egg farmers will exit the market, virtually ending egg production in Ohio. Most likely, only current cage-free producers will remain. It is also likely that these remaining farmers' costs would increase, due to the loss of economies of scale of large producers in the state who currently produce eggs using both methods.

References

"2007 Annual Report and Statistics." Ohio Department of Agriculture. 2008.

Farm Bureau. "Price Report: Tracking Milk and Egg Trends." 12 Oct. 2007. Farm Compliance. 18 May 2010. http://farmcompliance.com/content/view/44/2/

Food Safety: From the Farm to the Fork. "Animal Welfare on the Farm." European Commission. 26 Feb. 2009. http://ec.europa.eu/food/animal/welfare/farm/index_en.htm

National Agricultural Statistics Service. "2007 Census of Agriculture." United States Department of Agriculture. Dec. 2009.

National Agricultural Statistics Service. "Hired Workers Down 2 Percent, Wage Rates up 1 Percent From a Year Ago." Farm Labor. United States Department of Agriculture. 18 Feb. 2010.

"Ohio Livestock Care Standards Board News." Ohio Farm Bureau Federation. 18 May 2010. http://ofbf.org/news-and-events/livestockcareboard

"Ohioans for Humane Farms Petition for Anti-Cruelty Measure." 1 Feb. 2010. Humane Society of the United Sates. 5 March 2010. http://www.humanesociety.org/news/press_releases/2010/02/ohio_signatures_020110.html

Pollard, Terry. Big Dutchman, Inc. Personal Communication. 1 April 2010.

Promar International. "Impacts of Banning Cage Egg Production In the United States." United Egg Producers. Aug. 2009.

Sumner, D. A., H. Gow, D. Hayes, W. Matthews, B. Norwood, J. T. Rosen-Molina and W. Thurman. "Economic and market issues on the sustainability of egg production in the United States: analysis of alternative production systems." University of California Agricultural Issues Center. 2010.

Sumner, Daniel A., Thomas Rosen-Molina, William A. Matthews, Joy A. Mench and Kurt R. Richter. "Economic Effects of Proposed Resrictions on Egg-laying Hen Housing in California." University of California Agricultural Issues Center. July 2008.

Sumner, Daniel A., William A. Matthews, Joy a Mench, and J. Thomas Rosen-Molina. "The Economics of Regulations on Hen Housing in California." Southern Agricultural Economics Association Annual Meeting. 2010.

"Thinking Outside the Crate Campaign." Humane Society of the United States. 27 Feb 2009. http://www.hsus.org/farm/camp/totc/

United Egg Producers Certified. "Guidelines." 2002. United Egg Producers. 2 March 2009. http://www.uepcertified.com/program/guidelines/

"Veal Crates, Gestation Crates and Battery Cages Banned." 6 Nov. 2008. Humane Society of the United States. 5 March 2009. http://www.humanesociety.org/news/press_releases/2008/11/prop_2_international_110608.html

Tables

Table I: Ratios to Determine Cost of Production for Ohio Eggs

	Feed	Housing	Labor	Pullets
Ohio	$231.91	$15.82	$10.35	$2.17
California	284.11	17.95	11.05	2.56
Ratio of Ohio Costs:California Costs	$0.82	$0.88	$0.94	$0.85

Table II: Comparison of Production Costs Between Cage and Non-Cage Production Systems in Cost per Dozen

Production Factor	Cage Production System Range & Median ($ per dozen)	Non-Cage Production System Range & Median ($ per dozen)	Cost Differential Non-Cage - Cage System Using Mid-Points	Cost Differential Non-Cage - Cage System Using Low Costs
Pullets	0.08 - 0.09 0.085	0.12 - 0.15 0.132	0.047	0.04
Feed	0.23 - 0.37 0.298	0.27 - 0.43 0.35	0.051	0.04
Housing°	0.04 - 0.12 0.084	0.06 - 0.17 0.118	0.034	0.02
Labor†	0.03 - 0.04 0.033	0.04 - 0.05 0.042	0.009	0.01
Sum of Itemized Costs & Difference at the Mid-Points	0.500	0.641	0.141	
Sum of Itemized Costs & Difference at the Low Costs	0.374	0.490		0.116
Percentage Cost Difference Based on the Sum of Items			0.141/0.500 = 28%	0.116/0.374 = 31%
Total Cost‡	0.48 - 0.77 0.625	0.80 - 0.94 0.870	0.244	0.320
Percentage Cost Difference			0.244/0.626 = 39%	0.320/0.48 = 67%

°Housing includes cost of physical structure, equipment within structure, utilities, and maintenance/service/ supplies necessary to maintain operations

†Labor Costs based on operations with 20,000 layers or more

‡Total Cost is sum of main cost categories plus additional costs such as overhead, taxes, and misc. costs

Table III: Simulations of Cost Increasing Hen Housing Regulations on Prices and Quantities of Eggs in Ohio and the Rest of the United States

Farm Supply Elasticity ε	Change in Price of Eggs %	Egg Production in Ohio	Change in Rest of US Egg Production %
5	1.85%	Eliminate	8.34%
10	0.94%	Eliminate	8.51%

Table IV: Costs for Conversion to Cage-Free Egg Production in Ohio Assuming No Change in Current Production or Sales

Layer Capacity Required for Cage-Free Production			
Item	**Unit**	**Amount**	**Factor**
Current Table Egg Consumption (Ohio)	billion eggs	2.9	
Exports of Eggs to Other States	billion eggs	4.3	
Price Increase	percent	1.85	
Consumption Decline, Price Elasticity	percent	-0.4	-0.2
New Consumption	billion eggs	6.8	0%
Import Displacement	billion eggs	0.0	0%
Production Requirement	billion eggs	6.8	
Current Eggs Per Layer	number	264	
Reduction for Cage-Free	number	238	10%
Layer Capacity Required	million birds	28.7	
Building and Equipment Costs for Conversion to Cage-Free			
Item	**Unit**	**Amount**	**Factor**
Layer Capacity in 2007	million birds	27.1	
Current Cage-Free	million birds	0.5	2%
Current Cage	million birds	26.5	
Not Suited for Renovation	million birds	5.3	20%
To Renovate	million birds	21.2	
Houses @ 100,000	number	212.0	
New Capacity @40,000	million birds	12.7	60%
Renovation Cost	$ million	127.2	$9/hen
Renovated + Existing Cage-Free	million birds	21.7	
New Capacity Needed	million birds	7.0	
New Houses Needed @ 100,000	number	70.5	
Construction Cost	$ million	140.9	$20/hen
Land, Roads, Utilities for New Capacity	$ million	6.3	$90,000
Total Cost for Layer Houses	**$ million**	**274.5**	

(continued on next page)

Table IV (*Continued*): Costs for Conversion to Cage-Free Egg Production in Ohio Assuming No Change in Current Production or Sales

Pullet Capacity in 2007	million birds	8.8	
Current Cage-Free	million birds	0.2	
Current Cage	million birds	8.6	
Pullet Capacity Required	million birds	10.8	
Not Suited for Renovation	million birds	1.7	20%
To Renovate	million birds	6.9	
Houses @ 100,000	number	68.8	
New Capacity @ 50,000	million birds	3.4	50%
Renovation Cost	$ million	27.5	$8/hen
Renovated + Existing Cage-Free	million birds	7.1	
New Capacity Needed	million birds	3.7	
New Houses Needed @ 100,000	number	37.0	
Construction Cost	$ million	44.4	$12/hen
Land, Roads, Utilities for New Capacity	$ million	3.3	$90,000
Total Cost for Pullet Houses	**$ million**	**75.2**	
Total Cost	**$ million**	**349.7**	
Farmer will convert if New Capacity ≥ 2007 Capacity --->			Convert

*This simulation assumes that all farms will meet their current production level, including current out-of-state shipments. This would mean consumers in Ohio and export states would agree to pay premium for cage-free eggs.

**At 25% import displacement, New Layer Capacity < 2007 Capacity causing farmers to exit market; import displacement is likely to be 90% or greater